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Claims

[c1] 1. An outlet nozzle (10) for use in a liquid fuel rocket engine comprising:
a nozzle body having an axis (11) of revolution and a cross section which varies in diameter along said axis, said body having a wall structure comprising a plurality of mutually adjacent cooling channels (12) helically extending substantially in parallel from the inlet end (13) of the nozzle to its outlet end (14);
the nozzle (10) further comprising at least two longitudinally arranged sections (10a, 10b) and a shift between a positive and a negative channel angle in the transition from one section to an adjacent section.

[c2] 2. The outlet nozzle as recited in claim 1, further comprising:
different angles of the cooling channels (12) in the nozzle sections (10a, 10b) being adapted to quench reaction forces originating from exhausts flowing past said channels.

[c3] 3. The outlet nozzle as recited in claim 1, further comprising:
each cooling channel (12) extending helically with re-

spect to the longitudinal axis (11) of the nozzle (10).

[c4] 4. The outlet nozzle as recited in claim 1, further comprising:
the channels in each section (10a, 10b) having a constant cross section along their length.

[c5] 5. The outlet nozzle as recited in claim 1, further comprising:
the cross sectional area of the channels (12) of two adjacent nozzle sections (10a, 10b) being different.

[c6] 6. The outlet nozzle as recited in claim 1, further comprising:
the channel cross sectional area being larger for a downstream nozzle section than for an upstream nozzle section.

[c7] 7. The outlet nozzle as recited in claim 1, further comprising:
the channels (12) having a rectangular cross section.

[c8] 8. A method for manufacturing an outlet nozzle (10) for use in a liquid fuel rocket engine, said nozzle forming a body of revolution having an axis (11) of revolution and a cross section which varies in diameter along said axis, and having a wall structure comprising a plurality of mutually adjacent cooling channels (12), helically extending

substantially in parallel from the inlet end (13) of the nozzle to its outlet end (14), said method comprising:
joining a plurality of the tubular channels (12) to form a first section (10a) of the outlet nozzle (10) in which the channels has an angle of helix in relation to the longitudinal axis (11) of the nozzle;
joining a plurality of tubular channels (12) to form a second section (10b) of the outlet nozzle (10) in which the channels have opposite angles of helix in relation to the longitudinal axis of the nozzle, and
joining said sections (10a, 10b) to form a composite outlet nozzle (10) having continuous cooling channels (12).

[c9] 9. The method as recited in claim 8, further comprising:
said joining is realized by means of laser welding and the tubular channels (12) are joined by welding at the outside of the nozzle.

[c10] 10. The method as recited in claim 8, further comprising:
forming the tubular channels (12) by means of tubes having a rectangular cross section.

[c11] 11. The method as recited in claim 8, further comprising:
providing the meeting edges of sections to be joined with notches (15) at the outside to enable welding the remote part of the tubular channels from the outside of

the nozzle (10).

[c12] 12. The method as recited in claim 11, further comprising:

applying a ring shaped element (16) to bridge the notch area, and welding said element to the meeting channel ends.